Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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4432

Accredited to ISO/IEC 17025:2005

Caltest Instruments Limited

Issue No: 007 **Issue date:** 13 November 2017

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Calibration performed at the above address only

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC RESISTANCE			
Measurement	0 Ω	0.3 μΩ	
	1 mΩ to 10 mΩ	70 ppm	
	10 mΩ to 100 mΩ	60 ppm	
	100 mΩ to 1 Ω	25 ppm	
	1 Ω to 10 Ω	5.0 ppm	
	10 Ω to 100 Ω	5.0 ppm	
	100 Ω to 1 kΩ	6.0 ppm	
	10 kΩ	4.0 ppm	
	100 kΩ	4.0 ppm	
	1 MΩ to 10 MΩ	7.0 ppm	
	10 MΩ to 100 MΩ	8.0 ppm	
	100 MΩ to 1 GΩ	15 ppm	
	1 GΩ to 10 GΩ	35 ppm	
	100 GΩ	190 ppm	
Set Values	1.0 m Ω	70 ppm	
	10 m Ω	60 ppm	
	0.1 Ω	25 ppm	
	1.0 Ω	5.0 ppm	
	10 Ω	5.0 ppm	
	100 Ω	3.0 ppm	
	1.0 k Ω	4.0 ppm	
	10 k Ω	3.0 ppm	
Generation	1 Ω	10 ppm	
	10 Ω	5.0 ppm	
	100 Ω	4.0 ppm	
	1 kΩ	3.0 ppm	
	10 kΩ	4.0 ppm	
	100 kΩ	4.0 ppm	
	1 MΩ	10 ppm	
	10 MΩ	30 ppm	
DC VOLTAGE	0 V to 1.1 V	0.50 ppm + 0.82 μV	
	1.1 V to 11 V	0.50 ppm + 2.0 μV	
	11 V to 110 V	0.5 ppm + 2.1 μV	
	110 V to 1 kV	1.0 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC VOLTAGE (cont'd)	2 kV to 10 kV 1 kV to 2 kV	0.30 % 0.15 %	 Measurement only
DC CURRENT			
Measurement and Generation	1 μA to 100 mA 100 mA to 1 A 1 A to 10 A 10 A to 50 A 50 A to 100 A	17 ppm 55 ppm 75 ppm 200 ppm 300 ppm	
AC VOLTAGE	2 mV to 200 mV *40 Hz to 1 kHz* *1 kHz to 10 kHz* *10 kHz to 20 kHz* *20 kHz to 100 kHz*	 0.0060 % + 4.0 μV 0.0070 % + 4.0 μV 0.010 % + 8.0 μV 0.033 % + 20 μV	
	200 mV to 2 V *40 Hz to 1 kHz* *1 kHz to 10 kHz* *10 kHz to 20 kHz* *20 kHz to 100 kHz*	 0.0030 % + 20 μV 0.0007 % + 20 μV 0.0060 % + 40 μV 0.012 % + 200 μV	
	2 V to 20 V *40 Hz to 1 kHz* *1 kHz to 10 kHz* *10 kHz to 20 kHz* *20 kHz to 100 kHz*	 0.0030 % + 200 μV 0.0050 % + 200 μV 0.0050 % + 400 μV 0.011 % + 2.0 mV	
	20 V to 200 V *40 Hz to 1 kHz* *1 kHz to 10 kHz* *10 kHz to 20 kHz* *20 kHz to 100 kHz*	 0.0040 % + 2.0 mV 0.0040 % + 2.0 mV 0.0060 % + 4.0 mV 0.012 % + 20 mV	
	200 V to 500 V *40 Hz to 1 kHz* *1 kHz to 10 kHz* *10 kHz to 20 kHz*	 0.0080 % + 20 mV 0.011 % + 20 mV 0.032 % + 40 mV	
	500 V to 700 V *40 Hz to 1 kHz* *1 kHz to 10 kHz* *10 kHz to 20 kHz*	 0.010 % + 20 mV 0.013 % + 20 mV 0.038 % + 40 mV	
	700 V to 1000 V *40 Hz to 1 kHz* *1 kHz to 10 kHz* *10 kHz to 20 kHz*	 0.021 % + 20 mV 0.023 % + 20 mV 0.075 % + 40 mV	
	50 Hz to 60 Hz 1 kV to 2 kV 2 kV to 10 kV	 0.35 % 0.90 %	Measurement only

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC CURRENT	*40 Hz to 1 kHz* 5 mA to 100 mA 100 mA to 1 A 1 A to 10 A 10 A to 20 A *45 Hz to 60 Hz* 20 A to 100 A	 46 ppm 65 ppm 100 ppm 120 ppm 180 ppm	
FREQUENCY	40 Hz to 225 MHz	2.0 parts in 10^8	Frequency results may be expressed in terms of average periodic time.
ACTIVE POWER AND ENERGY	*45 to 65 Hz* 15 W to 2.4 kW 0.8 to unity PF 1 Ø 0.8 to unity PF 3 Ø 0.5 Power Factor 1 Ø 0.5 Power Factor 3 Ø 0.3 Power Factor 1 Ø 0.3 Power Factor 3 Ø	 75 ppm 60 ppm 85 ppm 85 ppm 110 ppm 110 ppm	Limiting voltage 60 V to 480 V * Limiting current 0.25 A to 5 A * The CMC is increased to 200 ppm at voltages greater than 120 V for which power factors other than unity are used.
	45 to 65 Hz 0.6 W to 120W, 300 W to 9.6 kW 0.8 to unity PF 1 Ø 0.8 to unity PF 3 Ø 0.5 Power Factor 1 Ø 0.5 Power Factor 3 Ø 0.3 Power Factor 1 Ø 0.3 Power Factor 3 Ø	 75 ppm 80 ppm 100 ppm 100 ppm 130 ppm 130 ppm	Limiting voltage 60 V to 480 V * Limiting current 0.01 A to 0.25 A and 5 A to 20 A * The CMC is increased to 200 ppm at voltages greater than 120 V for which power factors other than unity are used.
	45 Hz to 65 Hz 0.6W to 48 kW 0.3 to unity PF 1 Ø 0.3 to unity PF 3 Ø	 200 ppm 200 ppm	Limiting voltage 60 V to 480 V * Limiting current 0.01 A to 100 A * The CMC is increased to 200 ppm at voltages greater than 120 V for which power factors other than unity are used.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
REACTIVE POWER AND ENERGY	*48 Hz to 52 Hz* 3 VAr to 9.6 kVAr Zero Power Factor 1 Ø Zero Power Factor 3 Ø 0.866 Power Factor 1 Ø 0.866 Power Factor 3 Ø *48 Hz to 52 Hz* 1.2 kVAr to 48 kVAr Zero Power Factor 1 Ø Zero Power Factor 3 Ø 0.866 Power Factor 1 Ø 0.866 Power Factor 3 Ø	 90 ppm 100 ppm 100 ppm 110 ppm 110 ppm 120 ppm 120 ppm 130 ppm	Limiting voltage 60 V to 480 V * Limiting current 0.05 A to 20 A * The CMC is increased to 200 ppm at voltages greater than 120 V for which power factors other than unity are used. Limiting voltage 60 V to 480 V * Limiting current 20 A to 100 A * The CMC is increased to 200 ppm at voltages greater than 120 V for which power factors other than unity are used.
END			

Appendix - Calibration and Measurement Capabilities

Introduction

The definitive statement of the accreditation status of a calibration laboratory is the Accreditation Certificate and the associated Schedule of Accreditation. This Schedule of Accreditation is a critical document, as it defines the measurement capabilities, ranges and boundaries of the calibration activities for which the organisation holds accreditation.

Calibration and Measurement Capabilities (CMCs)

The capabilities provided by accredited calibration laboratories are described by the Calibration and Measurement Capability (CMC), which expresses the lowest uncertainty of measurement that can be achieved during a calibration. If a particular device under calibration itself contributes significantly to the uncertainty (for example, if it has limited resolution or exhibits significant non-repeatability) then the uncertainty quoted on a calibration certificate will be increased to account for such factors. The CIPM-ILAC definition of the CMC is as follows:

A CMC is a calibration and measurement capability available to customers under normal conditions:
(a) as published in the BIPM key comparison database (KCDB) of the CIPM MRA; or
(b) as described in the laboratory's scope of accreditation granted by a signatory to the ILAC Arrangement.

The CMC is normally used to describe the uncertainty that appears in an accredited calibration laboratory's schedule of accreditation and is the uncertainty for which the laboratory has been accredited using the procedure that was the subject of assessment. The CMC is calculated according to the procedures given in M3003 and is normally stated as an expanded uncertainty at a coverage probability of 95 %, which usually requires the use of a coverage factor of $k = 2$. An accredited laboratory is not permitted to quote an uncertainty that is smaller than the published CMC in certificates issued under its accreditation.

The CMC may be described using various methods in the Schedule of Accreditation:

As a single value that is valid throughout the range.
As an explicit function of the measurand or of a parameter (see below).
As a range of values. The range is stated such that the customer can make a reasonable estimate of the likely uncertainty at any point within the range.
As a matrix or table where the CMCs depend on the values of the measurand and a further quantity.
In graphical form, providing there is sufficient resolution on each axis to obtain at least two significant figures for the CMC.

Expression of CMCs - symbols and units

In general, only units of the SI and those units recognised for use with the SI are used to express the values of quantities and of the associated CMCs. Nevertheless, other commonly used units may be used where considered appropriate for the intended audience. For example, the term "ppm" (part per million) is frequently used by manufacturers of test and measurement equipment to specify the performance of their products. Terms like this may be used in Schedules of Accreditation where they are in common use and understood by the users of such equipment, providing their use does not introduce any ambiguity in the capability that is being described.

When the CMC is expressed as an explicit function of the measurand or of a parameter, this often comprises a relative term (e.g., percentage) and an absolute term, i.e. one expressed in the same units as those of the measurand. This form of expression is used to describe the capability that can be achieved over a range of values. Some examples, and an indication of how they are to be interpreted, are shown below.

DC voltage, 100 mV to 1 V: 0.0025 % + 5.0 µV:

Over the range 100 mV to 1 V, the CMC is 0.0025 %·V + 5.0 µV, where V is the measured voltage.

Hydraulic pressure, 0.5 MPa to 140 MPa: 0.0036 % + 0.12 ppm/MPa + 4.0 Pa

Over the range 0.5 MPa to 140 MPa, the CMC is 0.0036 %·p + ($0.12 \cdot 10^{-6} \cdot p \cdot 10^{-6}$) + 4.0 Pa, where p is the measured pressure in Pa.

It should be noted that the percentage symbol (%) simply represents the number 0.01. In cases where the CMC is stated only as a percentage, this is to be interpreted as meaning percentage of the measured value or indication.

Thus, for example, a CMC of 1.5 % means $1.5 \cdot 0.01 \cdot i$, where i is the instrument indication.